

Trend Study 29R-1-03

Study site name: Elephant Gap Total Exclosure.

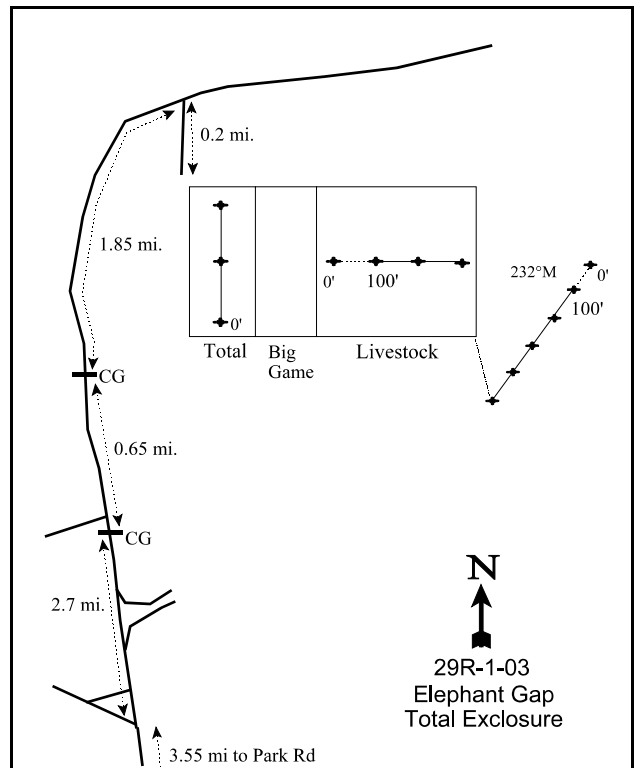
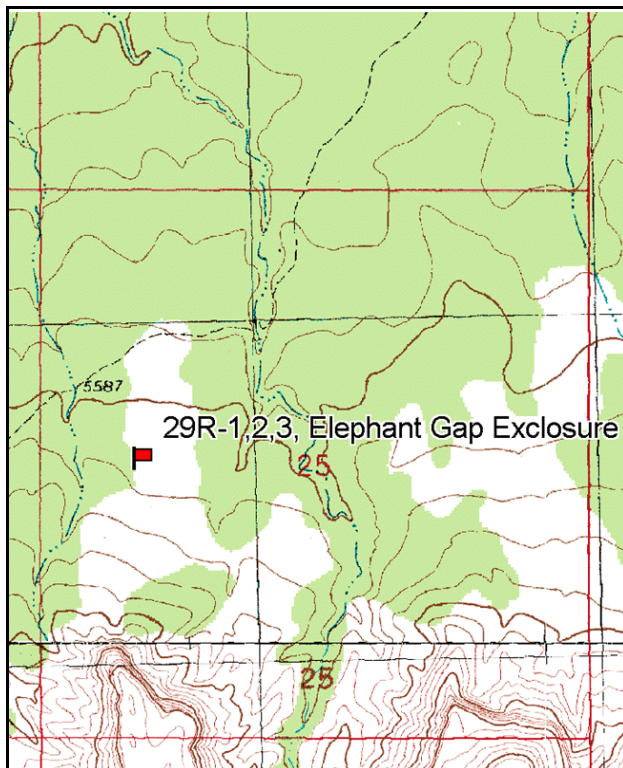
Vegetation type: Pinyon-Juniper .

Compass bearing: frequency baseline 50 degrees magnetic.

Frequency belt placement: line 1 (11ft, 59 ft, and 95 ft), line 2 (34ft and 71 ft).

LOCATION DESCRIPTION

The starting point for this site is the entry to Coral Pink Sand Dunes State Park off of Hwy 89. From the entry of the park, travel south for 4.2 miles. Turn right and go 3.55 miles to a fork. Stay right and continue 2.7 miles to a cattleguard. Continue on main road for another 0.65 miles to another cattleguard. Drive another 1.85 miles to a faint road to the right (south). Drive on this road for 0.2 miles to the exclosure. The total exclosure is nearest to the road and the baseline (200 feet long) runs through the middle at 50 degrees magnetic. The 0 foot stake is marked by browse tag #116.



Map Name: The Barracks

Diagrammatic Sketch

Township 42S, Range 9W, Section 25

GPS: NAD 27, UTM 12S 4110568 N, 339641 E

DISCUSSION

Elephant Gap Total Exclosure - Trend Study No. 29R-1

This study was established in 1998 inside the total exclosure at Elephant Gap. The Elephant Gap exclosure complex is located about 16 miles west-northwest of Kanab and about 9 miles northwest of the Coral Pink Sand Dunes State Park. The exclosure was built in the 1960's just north of Harris Point, and the total exclosure is approximately 100 feet by 200 feet in size. Slope is about 6% with a north to northwest aspect at an elevation of about 5,600 feet. The area supports a moderately dense stand of pinyon and juniper trees with a mixture of basin big sagebrush, bitterbrush, and serviceberry in the understory.

Soil at the site is very deep with an effective rooting depth estimated at over 31 inches. Texture is sand and reactivity is slightly acidic (6.2 pH). Phosphorus and potassium are limited at just 5.6 ppm and 12.8 ppm respectively. This could be effecting plant growth and development. Values below 10 ppm for phosphorus and 70 ppm for potassium are considered deficient. Soil temperature averaged nearly 70°F at a depth of 18 inches in 1998 and 2003. High soil temperatures combined with the sandy nature of the soil cause rapid drying of the soil profile which effectively limits shallow rooted plants. There is virtually no rock or pavement on the surface or within the profile. A considerable amount of bare ground was estimated in both surveys, but there is little erosion occurring due to the gentle slope and the rapid infiltration capacity of the soil.

There are a few small pinyon pine and large Utah juniper trees inside of the total exclosure. Average basal diameter was approximately 14 inches for juniper and 4 inches for pinyon. Juniper canopy cover was estimated at 12% in 1998 and 19% in 2003. Basin big sagebrush and bitterbrush are the key browse species. They combined to provide 48% and 41% of the shrub cover in 1998 and 2003 respectively. Density of basin big sagebrush was estimated at 1,280 plants/acre in 1998, decreasing to 760 in 2003. Density of dead plants increased to 960 plants/acre. Percent decadence was moderately low in 1998 at 19%, but increased to 53% in 2003. In addition, half of the basin big sagebrush population displayed poor vigor in 2003, an increase from 13% in 1998. It appears that basin big sagebrush will continue to decline in the future as 95% (~380 plants/acre) of the decadent age class was classified as dying in 2003. Annual leaders for basin big sagebrush averaged 1.9 inches in 2003.

There are only about 200 bitterbrush plants/acre inside the total exclosure with most of these being mature. No young bitterbrush were sampled in either survey. Decadence was low in 1998 at 8%, but moderate in 2003 at 30%. Bitterbrush annual leaders averaged 3.5 inches of growth in 2003. Small numbers of sand sagebrush, rubber rabbitbrush, green ephedra, coin buckwheat, squawbush, and yucca are also found inside of the exclosure.

The herbaceous understory is very poor. Total herbaceous cover was estimated at only 6% in 1998 and 3% in 2003. The most common perennial grasses are blue grama and sand dropseed, both warm season species. They accounted for 93% of the grass cover in 1998. With the exception of milkvetch, most of the herbaceous species on the site declined in 2003 with drought. Annual species are few.

1998 APPARENT TREND ASSESSMENT

The soil appears relatively stable even with the abundance of bare soil. There is some soil pedestalling apparent, but soil erosion appears minimal due to the gentle terrain combined with the high infiltration capacity of the soil. The key browse species, basin big sagebrush and bitterbrush, appear to have healthy and stable populations. Vigor is normal on most plants and percent decadence is low at 19% for sagebrush and 8% for bitterbrush. The herbaceous understory is lacking, although this may be all the site can support. Composition of grasses is dominated by the warm season species, primarily blue grama and sand dropseed. Forb composition is composed mostly of milkvetch and pale evening primrose.

2003 TREND ASSESSMENT

Trend for soil is stable. There were some slight changes in protective cover on the soil surface, but none of them would warrant a downward trend. Bare soil increased from 38% to 41%, while both vegetation and cryptogamic cover slightly declined. Litter cover increased from 44% to 51% in 2003. Trend for browse is down. Basin big sagebrush and bitterbrush have reduced population densities and increased decadence. The sagebrush population displays very poor vigor, and nearly all of the decadent age class was classified as dying which will likely result in future declines. Trend for the herbaceous understory is slightly down. Perennial grasses and forbs have lower sum of nested frequency values in 2003. The most abundant grasses, blue grama and sand dropseed, both significantly declined in 2003. Milkvetch remained stable while pale evening primrose significantly declined.

TREND ASSESSMENT

soil - stable (3)

browse - down (1)

herbaceous understory - slightly down (2)

HERBACEOUS TRENDS --

Management unit 29R, Study no: 1

Type	Species	Nested Frequency		Average Cover %	
		'98	'03	'98	'03
G	<i>Bouteloua gracilis</i>	_b 51	38	1.21	.22
G	<i>Bromus tectorum</i> (a)	4	-	.01	-
G	<i>Muhlenbergia pungens</i>	2	2	.03	.00
G	<i>Oryzopsis hymenoides</i>	2	3	.03	.16
G	<i>Sitanion hystrix</i>	-	3	-	.00
G	<i>Sporobolus cryptandrus</i>	_b 39	_a 5	.77	.07
G	<i>Stipa comata</i>	5	4	.00	.15
G	<i>Vulpia octoflora</i> (a)	_b 20	_a -	.09	-
Total for Annual Grasses		24	0	0.10	0
Total for Perennial Grasses		99	55	2.04	0.62
Total for Grasses		123	55	2.15	0.62
F	<i>Artemisia dracuncul</i>	5	-	.01	.03
F	<i>Arenaria</i> spp.	-	1	-	.03
F	<i>Astragalus</i> spp.	60	52	1.92	1.57
F	<i>Descurainia pinnata</i> (a)	7	4	.16	.00
F	<i>Dithyrea wislizenii</i> (a)	10	-	.27	-
F	<i>Eriogonum cernuum</i> (a)	9	-	.02	-
F	<i>Gilia</i> spp. (a)	_a 6	_b 19	.03	.32
F	<i>Lappula occidentalis</i> (a)	3	-	.03	-
F	<i>Oenothera albicaulis</i> (a)	-	1	-	.00
F	<i>Oenothera pallida</i>	_b 43	_a 16	1.06	.05

T y p e	Species	Nested Frequency		Average Cover %	
		'98	'03	'98	'03
	Total for Annual Forbs	35	24	0.52	0.32
	Total for Perennial Forbs	108	69	3.00	1.69
	Total for Forbs	143	93	3.52	2.02

Values with different subscript letters are significantly different at alpha = 0.10

BROWSE TRENDS --

Management unit 29R, Study no: 1

T y p e	Species	Strip Frequency		Average Cover %	
		'98	'03	'98	'03
B	Artemisia filifolia	15	12	.62	.73
B	Artemisia tridentata tridentata	37	33	6.46	5.61
B	Chrysothamnus nauseosus hololeucus	9	6	1.19	1.93
B	Ephedra viridis	6	5	.56	.57
B	Eriogonum nummularre	5	5	.33	.15
B	Juniperus osteosperma	1	2	7.94	9.25
B	Opuntia spp.	1	5	.03	.00
B	Purshia tridentata	9	9	3.56	4.09
B	Rhus trilobata	1	0	-	-
B	Tetradymia canescens	0	1	-	-
B	Yucca spp.	3	5	.16	1.34
	Total for Browse	87	83	20.88	23.71

CANOPY COVER, LINE INTERCEPT --

Management unit 29R, Study no: 1

Species	Percent Cover	
	'98	'03
Artemisia filifolia	-	1.13
Artemisia tridentata tridentata	-	3.71
Chrysothamnus nauseosus hololeucus	-	1.75
Ephedra viridis	-	1.13
Eriogonum nummularre	-	.38
Juniperus osteosperma	12.39	18.54
Opuntia spp.	-	.01

Species	Percent Cover	
	'98	'03
Purshia tridentata	-	4.34
Yucca spp.	-	1.06

KEY BROWSE ANNUAL LEADER GROWTH --
Management unit 29R, Study no: 1

Species	Average leader growth (in)
	'03
Artemisia tridentata tridentata	1.9
Purshia tridentata	3.5

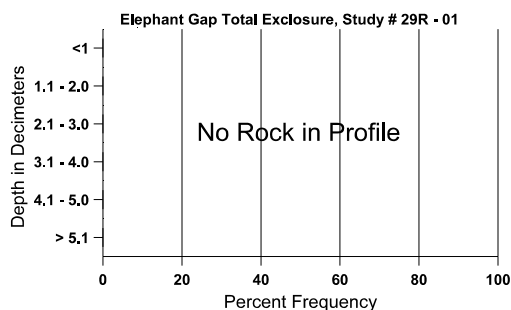
BASIC COVER --
Management unit 29R, Study no: 1

Cover Type	Average Cover %	
	'98	'03
Vegetation	28.10	25.73
Rock	0	.00
Pavement	0	.01
Litter	44.43	51.48
Cryptogams	5.10	2.59
Bare Ground	38.44	41.14

SOIL ANALYSIS DATA --
Management unit 29R, Study no: 1, Study Name: Elephant Gap Total Exclosure

Effective rooting depth (in)	Temp °F (depth)	pH	% sand	% silt	% clay	%OM	PPM P	PPM K	ds/m
31.4	68.0 (18.0)	6.2	90.7	4.7	4.6	0.6	5.6	12.8	0.3

Stoniness Index



PELLET GROUP DATA --

Management unit 29R, Study no: 1

Type	Quadrat Frequency		Days use per acre (ha)	
	'98	'03	'98	'03
Rabbit	2	22	N/A	N/A
Deer	1	9	N/A	N/A

BROWSE CHARACTERISTICS --

Management unit 29R, Study no: 1

		Age class distribution (plants per acre)					Utilization				
Y	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% poor vigor	Average Height Crown (in)
<i>Artemisia filifolia</i>											
98	380	-	120	260	-	20	0	0	0	0	24/63
03	280	-	20	120	140	40	0	0	50	7	23/25
<i>Artemisia tridentata tridentata</i>											
98	1280	120	220	820	240	560	0	0	19	13	35/45
03	760	-	80	280	400	960	0	0	53	50	31/33
<i>Chrysothamnus nauseosus hololeucus</i>											
98	2400	-	-	2400	-	40	0	0	0	0	41/81
03	120	-	-	40	80	60	0	0	67	33	36/55
<i>Ephedra viridis</i>											
98	160	-	40	60	60	-	0	0	38	0	28/26
03	100	-	-	100	-	-	0	0	0	0	29/32
<i>Eriogonum nummularre</i>											
98	120	-	40	80	-	-	0	0	0	0	22/23
03	140	-	-	100	40	40	0	0	29	14	17/19

		Age class distribution (plants per acre)					Utilization				
Y e a r	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% poor vigor	Average Height Crown (in)
Juniperus osteosperma											
98	20	-	20	-	-	-	0	0	-	0	-/-
03	40	-	-	40	-	-	0	0	-	0	-/-
Opuntia spp.											
98	20	-	-	-	20	-	0	0	100	0	4/14
03	100	-	-	80	20	-	0	0	20	20	5/16
Purshia tridentata											
98	240	-	-	220	20	40	0	0	8	8	48/64
03	200	-	-	140	60	100	20	10	30	10	48/92
Rhus trilobata											
98	20	-	-	20	-	-	0	0	-	0	-/-
03	0	-	-	-	-	-	0	0	-	0	-/-
Ribes spp.											
98	0	-	-	-	-	-	0	0	-	0	-/-
03	0	-	-	-	-	-	0	0	-	0	111/104
Tetradymia canescens											
98	0	-	-	-	-	-	0	0	-	0	-/-
03	20	-	-	20	-	-	0	0	-	0	34/42
Yucca spp.											
98	60	-	-	60	-	-	0	0	-	0	33/42
03	180	-	20	160	-	-	0	0	-	0	27/33

ELEPHANT GAP EXCLOSURE COMPARISON SUMMARY

Soil conditions are very similar between grazing effects. The soil is deep with a sandy texture and a slightly acidic to strongly acidic pH (5.4 to 6.2). Phosphorus and potassium appear to be limiting to plant growth and development on all sites, with some values well below 10 ppm for phosphorus and 70 ppm for potassium. Organic matter is low over all treatments. Percent bare ground is high on all sites, but highest outside of the exclosures at over 50% in 2003. Vegetation cover was highest in the livestock exclosure in 1998, with similar amounts outside and in the total exclosure. In 2003, the livestock and total exclosures had similar vegetation cover estimates, while outside was considerably less. Cryptogamic crusts were abundant outside and in the livestock exclosure at over 10% in 1998 and 7% in 2003. Soil temperatures are high on all sites averaging about 70°F. High soil temperatures combined with the high infiltration rates of the soil result in rapid soil drying in the surface horizons. This could be limiting to the establishment of shallow rooted plants. Soil erosion on all treatment effects appears to be minimal due to the levelness of the terrain, combined with the high infiltration capacity of the soil.

The key browse species for all grazing effects is basin big sagebrush and green ephedra. Antelope bitterbrush is the most preferred but it occurs in very low densities and is not abundant enough to be considered a key species at Elephant Gap. It's highest density occurs inside the total exclosure where big game and livestock do not have access. Basin big sagebrush density is similar between all 3 grazing effects ranging from about 1,200-1,500 plants/acre in 1998. Sagebrush density declined in all 3 treatments in 2003 with the largest decrease coming outside. The number of dead sagebrush increased in all 3 treatments in 2003, nearly doubling inside the total exclosure and outside. Dead sagebrush now outnumber live individuals on all 3 transects in 2003. Sagebrush recruitment was lowest in the livestock exclosure in 1998 at 7%, and highest in the total exclosure at 17%. Recruitment decreased in all 3 treatments in 2003, but remained fair in the total exclosure and outside at 11%. Percent decadence was average inside the total exclosure at 19% in 1998, but moderately high in the livestock exclosure and outside at 46% and 45% respectively. In 2003, decadence increased to 53% in the total exclosure, 74% outside, and 95% in the livestock exclosure. Poor vigor was high on all 3 transects in 2003 ranging from 44%-57%.

Several factors appear to be effecting sagebrush at Elephant Gap. Drought is likely the primary driving force behind deteriorating sagebrush health, but winter injury could also be a factor. Winter injury is presumably caused by freezing due to a lack of sufficient cold hardiness and/or winter drought or dessication (Nelson and Tiernan 1983). During mild winters, sagebrush can break dormancy during the middle of the winter and begin growth too early in the year. By doing so, sagebrush plants become susceptible to dessication and crown death if temperatures become very cold for any substantial length of time. Sagebrush injury also occurs because available soil moisture is minimal during winter months, especially within these deep sandy soils. Sagebrush conditions inside the livestock exclosure and outside were worse compared to the total exclosure with higher decadence rates and a larger number of dead plants in 2003. It appears that use could be an additive factor in addition to drought and winter injury in these 2 grazing effects.

In 1998, green ephedra density was highest inside the livestock exclosure, intermediate outside, and lowest in the total exclosure. Density slightly declined in the exclosure treatments, but increased outside in 2003. The proportion of young ephedra plants was high in all 3 treatments in 1998, declining somewhat in the livestock exclosure and outside in 2003. No young were sampled in the total exclosure in 2003. Ephedra has maintained relatively good vigor in both surveys in all treatments, and decadence has been low to moderate.

The herbaceous understory is limited on all grazing effects, particularly grasses. In 1998 and 2003, total herbaceous cover in order of decreasing abundance was as follows: outside, livestock exclosure, and total exclosure. Grass composition is similar between all sites, with the most common perennial species being blue grama, sand dropseed, bottlebrush squirreltail, Indian ricegrass, and needle-and-thread. Annual grasses, cheatgrass and sixweeks fescue, were also sampled on all 3 sites in 1998. With drought conditions in 2003,

perennial grass nested frequency declined in all grazing effects, and sixweeks fescue was only sampled outside the exclosures. Forb composition is similar between treatment effects with respect to the dominant species, but more species are found in the livestock exclosure and outside. Forb cover was 3 times higher in both the livestock exclosure and outside the exclosure in 1998 than in the total exclosure. The most abundant forbs in 1998 were pale evening primrose, prairie evening primrose, toadflax, and milkvetch. Both primrose's and toadflax decreased on all 3 sites in 2003, with milkvetch remaining stable in the livestock and total exclosures, and increasing outside.